[0035] CLAIMS

1. A tunable laser cavity sensor chip comprising:

(a) a reference laser and a sensor laser, each comprising a waveguide having a gain section, opposing mirrors including a partially transmissive mirror, and a coherent light beam output section, at least one of the waveguides having a phase control section, the coherent light beam output sections being joined to enable coherent light outputs of the reference and sensor lasers to interfere;

(b) a sensor region formed through and exposing the evanescent optical field of the sensor laser, for receiving a sample to be diagnosed; and

(c) a heterodyne detector at the juncture of the reference and sensor coherent light output sections for detecting a change in the frequency of the coherent light output from the sensor laser resulting from a change in the index of refraction of fluid in the sensor cavity.

2. The chip device of claim 1 wherein the mirror on each laser opposing the partially transmissive mirror is a facet mirror.

3. The chip device of claim 1 wherein the partially transmissive mirror and the opposing mirror are both sampled-grating mirrors having different sampling periods.

4. The chip device of claim 1 in which said exposed evanescent field region is between the gain section and one of the mirrors of the sensor laser.

5. The chip device of claim 1 in which the sensor laser includes said phase control section.

6. A system for the identification of a plurality of molecular species comprising a plurality of pairs of reference and sensor lasers of claim 1 having a common source of molecules to be diagnosed

7. The system of claim 6 in which the outlet of one pair of reference and sensor lasers is connected in series to the outlet of another pair of reference and sensor lasers.

8. A method for detecting a molecular species in a sample, comprising:

directing sample to be tested for said molecular species to the inlet of a sample chamber of a tunable cavity sensor chip of claim 1; and

detecting a shift in frequency of the heterodyned coherent light outputs of the reference and sensor lasers thereof.

9. A method for detecting a plurality of molecular species, comprising:

establishing a heterodyned frequency of a first pair of lasers carried by a chip, one of which has exposed evanescent field material carrying a first ligand thereon for a first molecular species;

directing molecules to be diagnosed from a source thereof to said first ligand;

detecting a shift in the heterodyned frequency as an indicator of the presence of said first molecular species; and

repeating the foregoing steps with a second pair of lasers carried by said chip having a second ligand carried by evanescent field material, whereby to detect a shift in the heterodyned frequency thereof as an indicator of the presence of said second molecular species.

10. The method of claim 9 in which molecules to be diagnosed are directed from said first ligand to said second ligand.

11. The method of claim 9, in which the frequency or wavelength of the reference and sensor lasers are shifted to determine the properties of detected species as a function of wavelength.